

[illegible]

assembly does not have a good balance of rotation, a shaft deflection vibration is increased at a time of rotating the disc, whereby an accuracy in a positioning direction is deteriorated. Further, a vibration in a vertical direction due to an unbalance of rotation rounds into a fluctuation of flying height. Accordingly, it is necessary that the disc assembly satisfies the balance of rotation.

As a method for preventing the unbalance of rotation as mentioned above, there has been conventionally proposed various kinds of methods. For example, in Japanese Unexamined Patent Publication No. 10-149616, there is disclosed a magnetic disc apparatus employing a plurality of discs in an overlapping manner, in which the discs are biased at a tolerance between a motor hub and a fixing hole of the discs, whereby a center of gravity of all combined discs is coincided with a center of a spindle motor. In the structure, for example, in the case of two discs, the discs are biased in direct opposition at a tolerance, and in the case of three discs, the discs are biased at 120 degrees.

In the prior art mentioned above, the assembling step is easily executed, however, in accordance with this method, an inner diameter of the disc and a side surface of the hub are in contact with each other at any area on a circumference. In this state, in the case that the hub is deformed due to a

5 SUMMARY OF THE INVENTION

In accordance with the invention described in
10 the present specification, a disc apparatus can be
assembled so that the unbalance of the rotating portion
can be reduced while restricting a deformation of the
disc due to a heat history or the like without
increasing a required space.

The object mentioned above can be achieved by a method of assembling a disc-like recording medium comprising:

a first step of mounting a disc-like
25 recording medium to a disc apparatus in a state capable
of moving the disc-like recording medium with respect
to a hub of a spindle motor in a direction of a disc

a second step of pressing an outer diameter of the disc in a direction of a center axis of the hub by a first flat member so as to bring an inner diameter of the disc into contact with an outer diameter of a rotary axis of the hub;

a third step of pressing back the outer diameter of the disc contact with the first flat member and the outer diameter of the disc at an opposite position to the center of the disc in an inverse direction to a pressing direction of the first flat member to a half of an amount of tolerance between the inner diameter of the disc and the outer diameter of the hub, by a second flat member placed substantially in parallel to the first flat member and in an opposite side to the center axis of the hub; and

Further, the object can be achieved by a method of assembling a disc-like recording medium comprising:

a first step of mounting a disc-like recording medium to a disc apparatus in a state capable of moving the disc-like recording medium with respect to a hub of a spindle motor in a direction of a disc radius;

a second step of pressing an outer diameter
of the disc in a direction of a center axis of the hub

a third step of pressing back the outer

5 diameter of the disc contact with the first flat member
and the outer diameter of the disc at an opposite
position to the center of the disc in an inverse
direction to a pressing direction of the first flat
member by a second flat member placed substantially in
10 parallel to the first flat member and in an opposite
side to the center axis of the hub until the outer
diameter of the hub and the inner diameter of the disc
are in contact with each other, and measuring an amount
of pressing back, that is, a difference between the
15 outer diameter of the hub and the inner diameter of the
disc;

a fourth step of pressing back a half of the difference between the outer diameter of the hub and the inner diameter of the disc by the first flat member; and

a fifth step of fixing the disc to the spindle motor hub by a clamp member.

The structure may be made such that a pressurizing means for pressing the disc toward the center axis of the hub is provided in a portion to which the first flat member is mounted.

Further, the object can be achieved by a method of assembling a disc-like recording medium

a first step of fixing a magnetic disc
apparatus base on which a spindle motor is mounted;

a second step of mounting a disc-like
5 recording medium to a disc apparatus in a state capable
of moving the disc-like recording medium with respect
to a hub of a spindle motor in a direction of a disc
radius;

a third step of pressing an outer diameter of
10 the disc in a direction of a center axis of the hub by
a first flat member so as to bring an inner diameter of
the disc into contact with an outer diameter of a
rotary axis of the hub;

a fourth step of pressing back the outer diameter of the disc contact with the first flat member and the outer diameter of the disc at an opposite position to the center of the disc in an inverse direction to a pressing direction of the first flat member to a half of an amount of tolerance between the inner diameter of the disc and the outer diameter of the hub, by a second flat member placed substantially in parallel to the first flat member and in an opposite side to the center axis of the hub; and

a fifth step of fixing the disc to the spindle motor hub by a clamp member. In this case, it is possible to add a step of measuring a difference between the outer diameter of the hub and the inner diameter of the disc. Further, a pressurizing means

The means mentioned above can be applied to a centering operation of a spacer ring employed at a time of assembling a plurality of discs, in addition to the disc-like recording medium.

Fig. 1 is a schematic view showing an
10 embodiment of a method of assembling a disc medium in
accordance with the present invention;

Fig. 2 is a schematic view showing a pressurizing means for pressing a disc in accordance with an embodiment of the present invention;

15 Fig. 3 is a route chart of an embodiment of a
method of assembling a disc medium in accordance with
the present invention;

Fig. 4 is a schematic view showing an embodiment of a method of assembling a disc medium in accordance with the present invention;

Fig. 5 is a schematic view showing an embodiment of a method of assembling a disc medium in accordance with the present invention;

Fig. 6 is a schematic view showing an
25 embodiment of a method of assembling a disc medium in
accordance with the present invention;

Fig. 7 is a schematic view showing an

embodiment of a method of assembling a disc medium in accordance with the present invention; and

Fig. 8 is a schematic view showing a structure of a disc rotation preventing means employed in a method of assembling a disc medium in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A description will be given of embodiments in accordance with the present invention with reference to the accompanying drawings.

Fig. 1 is a schematic view showing an embodiment of a method of assembling a disc medium in a magnetic disc apparatus in accordance with the present invention, Fig. 2 is a schematic view showing an embodiment of a pressurizing means, and Fig. 3 is a schematic view showing a work sequence of an assembling method. The present embodiment shows an example of mounting one disc on a disc apparatus.

A base 1 of a magnetic disc apparatus on which a spindle hub 2 is mounted is rigidly fixed onto a common base 20 of a disc assembling apparatus in accordance with the present invention by jigs 9 and 10. A first flat member 4 and a second flat member 7 which are arranged in a symmetrical manner with respect to a center of the hub 2 are respectively mounted on stages 6 and 8 capable of moving toward a center of the hub, and each of the stages is placed on the common base 20.

A pressurizing means 5 constituted by a spring 5a for applying a force pressing a disc 3 toward a center of the hub is placed in the first flat member 4. Further, a displacement gauge 11 is placed for monitoring an amount of displacement of the first flat member 4. A description will be given of an operation of the present embodiment with reference to Fig. 3.

At first, the disc is mounted on the spindle hub. Next, the first flat plate 4 is moved toward the center of the hub while pressing the outer diameter of the disc 3. At this time, the movement is performed until the inner diameter of the disc is in contact with the hub 2 and detects a resistance force. This moving direction is set to an x direction and a direction perpendicular thereto is set to a y direction. At this time, a slip or a rolling is generated at a contact point among the first flat member 4, the second flat member 7 and the outer diameter of the disc 3, and a contact point between the inner diameter of the disc and the outer diameter of the hub. Since a position at which a center of the hub 2 in the y direction coincides with a center of the disc 3 is the most stable point, the centering in the y direction is completed by converging to this position. Thereafter, when moving the stage 6 toward the center of the hub, a spring force of the pressurizing means 5 is applied to the disc 3 which is in contact with the first flat member. In this case, a spring constant of a spring 5a

15 Next, the second flat member 7 in an opposite
side is moved in a direction of $-x$. Accordingly, it is
possible to move the disc 3 held in a state of
centering in the y direction with respect to the first
flat member toward the direction of $-x$ by pressing the
20 outer diameter portion of the disc in an opposite side
to the center of the hub. The movement is performed
until the inner diameter of the disc in the side of the
second flat member 7 is in contact with the hub 2 so as
to detect the resistance force. An amount of
25 displacement at this time corresponds to a difference
between the outer diameter of the hub and the inner
diameter of the disc in the x direction, that is, an
amount of gap.

Next, the second flat member 7 is returned at a half of the measured amount of the gap in a moving stage 8 in the side of the second flat member 7. At this moment, the centering in the x direction is
5 completed. It is possible to employ a method of previously calculating an average amount of gap on the basis of a tolerance of the inner diameter of the used discs and a tolerance of the outer diameter of the hub so as to omit the part of measuring the gap mentioned
10 above, and moving the second flat member in the direction of -x at a known amount of gap. In this case, in comparison with the method of determining the position of center by comprehending the amount of gap in each case, a dispersion due to an individual
15 difference is added as a centering error.

In accordance with the present embodiment, there is shown a method of measuring the amount of gap by the displacement gauge 11, however, it is possible to employ a structure substituted by the stages 6 and
20 8.

Figs. 4 and 5 are schematic views showing a method of fixing the disc medium in a state of being centered by the means mentioned above to the hub by a clamp. A spring force of the clamp 12 is generated by
25 putting the clamp 12 on the disc 3 and the hub 2 and fastening a clamp screw 13 with respect to the hub by a screw driver 17, whereby the disc is fixed to the hub. At a time of fastening the clamp screw, a rotation

preventing member 16 for the hub is employed so as to prevent the spindle hub 2 from rotating due to a rotational torque. A rotation preventing pin 16a is placed in the rotation preventing member 16, and it is possible to prevent the hub from rotating by inserting the pin 16a to a groove hole 15 provided on an upper surface of the hub. A hole 14 for passing the pin therethrough is pieced in the clamp 12.

Since the disc 3 is under a state of being centered with respect to the center of the hub, in the case of attaching the rotation preventing member in a state that the center of the rotation preventing member and the center of the hub are shifted, the hub is displaced, and the centering of the disc is deteriorated. In order to make a success of centering and assembling, it is necessary that the hub is not displaced.

Then, as shown in Fig. 8, the rotation preventing member 16 is set under a soft fixed state within an x-y plane by a rotation preventing apparatus 800. The rotation preventing apparatus 800 shown in Fig. 8A is structured such that the rotation preventing member 16 is supported in a direction of the x-y plane parallel to the disc recording plane and a force for restricting a movement of the member 16 is applied thereto. That is, rails 803 and 805 respectively formed in an x direction and a y direction corresponding to a rotation preventing direction in

5 Further, the pedestals 804 and 806 are supported on the
x-direction supporting apparatus 801 and the y-
direction supporting apparatus 802 by elastic members
(for example, springs or the like) applying repulsive
force to motions in the x direction and the y direction
0 so as to flexibly restrict the position. Then, the
rotation preventing member 16 is bonded to any one of
the pedestals 804 and 806 and is fixed by a fixing
means 809.

The rotation preventing apparatus 800 is, as shown in Fig. 8B, arranged in a side portion of the disc base 1 a position of which is fixed, moves the rotation preventing member 16 above the clamp 12 mounted on the disc 3 so that the clamp hole 14 coincides with the position of the groove hole 15 on the hub 2, and is adjusted so that the pin 16a is accurately positioned on the hole 14.

In this state, although an illustration is omitted, the pin 16a is fitted to the groove hole 15 by the rotation preventing apparatus 800 or a means for moving the base 2 in a vertical direction. At this time, the rotation preventing member 16 is set under the soft fixed state within the x-y plane by the rotation preventing apparatus 800, and the diameter of

the rotation preventing pin 16a is set to a size having a sufficient gap with respect to the groove hole 15 of the hub and the hole 14 of the clamp, whereby the structure is made such that the rotation preventing member 16 is automatically aligned with the hub 2.

Figs. 6 and 7 are schematic views of another embodiment in accordance with the present invention. In the previous embodiment, the structure is made such that one disc is positioned to the hub, however, the present embodiment is structured such that two (a plurality of) discs are mounted on the disc apparatus.

In the present embodiment, the same steps as those of the first embodiment are employed until the magnetic disc mounting the spindle hub 2 is rigidly fixed to the base 1. Next, a lower disc 3a is mounted and is centered by using the flat members 4 and 7. This method is the same as that of the first embodiment. Each of the flat members 4 and 7 used for centering the lower disc is structured such that only a height position portion of the lower disc is formed in a convex shape as shown in Fig. 7 so as to be prevented from being in contact with the upper disc. A spacer 21 and an upper disc 3b are mounted in a state of holding the lower disc 3a by the first and second flat members 4 and 7 used for positioning in a state of centering.

Next, the upper disc 3b is centered by using third and fourth flat members 24 and 27 independent from the first and second flat members 4 and 7 used for

centering the lower disc. This method is the same as that of the first embodiment. When the centering is finished, the disc is fixed to the hub by using the clamping method mentioned above. Accordingly, it is possible to center and assemble two discs. In accordance with the method mentioned above, when setting a plurality of discs, a corresponding number of flat members to the number of discs are required. However, in the case that the holding member for holding the set disc is independently provided at a time of setting another disc, one set of flat members are sufficient.

In this case, there is shown a method of centering only the disc medium, however, the centering can be achieved by adding the same structure to the spacer 21. Further, the present embodiment illustrates the case having two discs, however, as previously mentioned, the present embodiment can be applied to an assembly of two or more discs.

In the first and second embodiments, there can be employed a structure made such that in order to keep a friction state of the portion being in contact with the outer diameter of the disc in a fixed state, a front end portion of the flat member can be replaced so as to be replaced after a fixed time use.

In general, in the disc assembling automatic machine used in a process of manufacturing the magnetic disc, it is easy to employ the structure shown in the

5 can be listed up as an embodiment.

10 information in advance in place of mounting the disc
medium to the magnetic disc apparatus as in the

20 rotating portion while restricting the disc deformation due to the heat history or the like without increasing the required space, that is, a simple method of centering the disc medium so as to mount to the spindle motor.